CLAIMS

I/We claim:

[c1] 1. A method for packaging a microelectronic substrate, comprising:

positioning a microelectronic substrate proximate to a support member, the microelectronic substrate having a first surface, a second surface facing opposite from the first surface, and a plurality of first connection sites at least proximate to the first surface, the support member having a plurality of second and third connection sites;

connecting the microelectronic substrate to the support member by attaching a plurality of electrically conductive couplers between the plurality of first connection sites of the microelectronic substrate and the plurality of second connection sites of the support member, with neighboring conductive couplers being spaced apart to define at least one fluid flow channel, and with the support member and the microelectronic substrate forming a package; and

providing the package for electrical coupling to other electrical structures, with the third connection sites accessible for electrical coupling to the other electrical structures, and with the at least one fluid flow channel accessible to a region external to the package.

[c2] 2. The method of claim 1, further comprising cooling th microelectronic substrate by passing a flow of gaseous fluid through the at least one fluid flow channel while the package is electrically coupled to the other electrical structures.

[c3] 3. The method of claim 1, further comprising:

applying the conductive couplers to the first connection sites;

applying a generally non-conductive support material to the first surface of the microelectronic substrate and adjacent to the conductive couplers;

removing material from the second surface of the microelectronic substrate to thin the microelectronic substrate; and

removing at least some of the generally non-conductive support material from between at least some of the conductive couplers to form the at least one fluid flow channel.

[c4] 4. The method of claim 1, further comprising selecting the conductive couplers to include solder balls.

[c5] 5. The method of claim 1, further comprising applying an adhesive material at an interface between the microelectronic substrate and the support member, with the adhesive material having at least one opening positioned to allow fluid communication between the at least one fluid flow channel and a region external to the package.

[c6] 6. The method of claim 1, further comprising:

applying a generally non-conductive material to the first surface of the microelectronic substrate adjacent to the conductive couplers; and

forming the cooling flow channel by etching at least some of the generally non-conductive material from between at least some of the conductive couplers.

[c7] 7. The method of claim 1, further comprising:

applying a generally non-conductive material to the first surface of the microelectronic substrate and adjacent to the conductive couplers; and

forming the at least one fluid flow channel by etching at least some of the material from betwe n at least some of the conductive couplers to expose at least a portion of the conductive couplers.

[c8] 8. The method of claim 1, further comprising:

applying a generally non-conductive first material to the first surface of the microelectronic substrate adjacent to the conductive couplers; and

applying a generally non-conductive second material to the support member, with the first and second generally non-conductive materials being separated by a gap, and with the gap defining the at least one fluid flow channel.

[c9] 9. The method of claim 1, further comprising selecting the microelectronic substrate to include at least one memory device.

[c10] 10. A method for packaging a microelectronic substrate, comprising:

providing a microelectronic substrate having a first surface, a second surface facing opposite from the first surface, and a plurality of first connection sites at least proximate to the first surface;

disposing flowable, electrically conductive couplers at the first connection sites;

disposing a generally non-conductive material between the conductive couplers;

selecting a gap dimension based on a target underfill material flow rate;

removing at least a portion of the generally non-conductive material to form a gap between neighboring conductive couplers, the gap having the selected gap dimension in a direction generally normal to the first surface of the microelectronic substrate;

connecting the microelectronic substrate to a support member by attaching the conductive couplers to second bond sites of the support member; and

flowing an underfill material into the gap at at least approximately the target underfill material flow rate.

[c11] 11. The method of claim 10 wherein selecting the gap dimension includes selecting the gap dimension to be at least 25 microns.

[c12] 12. The method of claim 10 wherein the underfill material includes a plurality of particles having a mean diameter, and wherein selecting the gap dimension includes selecting the gap dimension to be at least three times th mean diameter of the particles.

[c13] 13. The method of claim 10 wherein the microelectronic substrate has a plurality of edges, and wherein the method further comprises disposing the underfill material along at least one of the edges, further wherein flowing an underfill material into the gap at at least approximately the target underfill material flow rate includes filling the gap before the underfill material wicks completely around the edges of the microelectronic substrate.

[c14] 14. The method of claim 10, further comprising selecting the conductive couplers to include solder balls.

[c15] 15. The method of claim 10, further comprising selecting the conductive couplers to include a flux material and a plurality of solder particles disposed in the flux material.

[c16] 16. The method of claim 10, further comprising removing material from the second surface of the microelectronic substrate to thin the microelectronic

substrate before removing at least a portion of the generally non-conductive material.

[c17] 17. The method of claim 10 wherein removing at least a portion of the generally non-conductive material includes etching at least some of the generally non-conductive material.

[c18] 18. A method for processing microelectronic substrates, comprising:

providing a first microelectronic substrate having a first surface, a second surface facing opposite from the first surface, and a plurality of first connection sites positioned at least proximate to the first surface, each first connection site carrying a first flowable, electrically conductive coupler, each first conductive coupler having a first outer surface spaced apart from the first surface of the first microelectronic substrate by a first distance, the first outer surfaces defining a first plane;

applying a first generally non-conductive material to the first conductive couplers and the first surface of the first microelectronic substrate;

selecting a first recess distance;

removing at least some of the first generally non-conductive material from between the first conductive couplers to recess the first generally non-conductive material from the first plane by the first recess distance;

providing a second microelectronic substrate having a first surface, a second surface facing opposite from the first surface, and a plurality of second connection sites positioned at least proximate to the first surface of the second microelectronic substrate, each second connection site having a second flowable, electrically conductive coupler, each second conductive coupler having a second outer surface spaced apart from the first surface of the second

microelectronic substrate by a second distance different than the first distance, the second outer surfaces defining a second plane;

applying a second generally non-conductive material to the second conductive couplers and the first surface of the second microelectronic substrate;

selecting a second recess distance to be at least approximately the same as the first recess distance; and

removing at least some of the second generally non-conductive material from between the second conductive couplers to recess the second generally non-conductive material from the second plane by the second recess distance.

[c19] 19. The method of claim 18, further comprising:

removing material from the second surface of the first microelectronic substrate to thin the first microelectronic substrate prior to removing at least some of the first generally non-conductive material; and

removing material from the second surface of the second microelectronic substrate to thin the second microelectronic substrate prior to removing at least some of the second generally non-conductive material.

[c20] 20. The method of claim 18, further comprising selecting the first and second generally non-conductive materials to have at least approximately the same composition.

[c21] 21. The method of claim 18, further comprising selecting the first and second conductive couplers to include solder balls.

[c22] 22. The method of claim 18, further comprising selecting the first and second recess distances to be about 25 microns or more.

[c23] 23. The method of claim 18, further comprising flowing an underfill material between the first microelectronic substrate and a first support member attached to the first conductive couplers, wherein the underfill material includes a plurality of particles, the particles having a mean diameter, and wherein selecting the first and second recess distances includes selecting the first and second recess distances to be about three times the mean diameter of the particles.

[c24] 24. A method for forming a microelectronic package, comprising:

positioning a microelectronic substrate proximate to a support member, the microelectronic substrate having a first surface, a second surface facing opposite from the first surface, and a plurality of first connection sites at least proximate to the first surface, the support member having a plurality of second connection sites;

connecting the microelectronic substrate to a support member by attaching conductive couplers between the first connection sites of the microelectronic substrate and the second connection sites of the support member; and

disposing at least one generally non-conductive material adjacent to the conductive couplers, the at least one generally non-conductive material being spaced apart from the support member.

[c25] 25. The method of claim 24 wherein the at least one generally non-conductive material is a first generally non-conductive material, and wherein the method further comprises disposing a second generally non-conductive material adjacent to the support member and the conductive couplers, the second generally non-conductive material being spaced apart from the first generally non-conductive material.

[c26] 26. The method of claim 24, further comprising separating the microelectronic substrate from the support member without damaging either the microelectronic substrate or the support member.

[c27] 27. The method of claim 24, further comprising separating the microelectronic substrate from the support member by elevating a temperature of the conductive couplers.

[c28] 28. The method of claim 24 wherein the microelectronic substrate is a first microelectronic substrate and wherein the method further comprises removing the first microelectronic substrate from the support member and attaching a second microelectronic substrate to the support member in place of the first microelectronic substrate.

[c29] 29. The method of claim 24 wherein attaching conductive couplers between the first and second connection sites includes disposing on the second connection sites a flux material, and elevating a temperature of the flux material.

[c30] 30. The method of claim 24 wherein disposing a first generally non-conductive material adjacent to the conductive couplers includes disposing on the second connection sites a flux material having an epoxy component, and wherein the method further includes curing the epoxy.

[c31] 31. A method for forming a microelectronic package, comprising:

providing a microelectronic substrate having a first surface, a second surface facing opposite from the first surface, and a plurality of first connection sites positioned at least proximate to the first surface, with each first connection site carrying a flowable conductive coupler, the conductive couplers having an outer surface defining an outer surface plane spaced apart from the first surface, the

microelectronic substrate further having a first generally non-conductive material disposed between the conductive couplers, the first generally non-conductive material being recessed from the outer surface plane to define a flow channel between the volumes of flowable conductive material, the flow channel having an inner region and an outer region disposed outwardly from the inner region;

disposing a second generally non-conductive material on a support member, the support member having a plurality of second bond sites, the second generally non-conductive material forming a layer over the second bond sites, the layer having a first region and a second region disposed outwardly from the first region, the first region having a greater thickness than the second region;

engaging the inner region of the flow channel with the first region of the second generally non-conductive material while the second generally non-conductive material is at least partially flowable; and

moving at least one of the microelectronic substrate and the support member toward the other while forcing gas within the flow channel generally outwardly through the flow channel to the outer region of the flow channel.

[c32] 32. The method of claim 31 wherein disposing the first generally non-conductive material includes disposing an epoxy material.

[c33] 33. The method of claim 31 wherein disposing the second generally non-conductive material includes disposing an underfill material.

[c34] 34. The method of claim 31 wherein disposing the second generally non-conductive material includes disposing the second generally non-conductive material to have an at least approximately dome shaped volume.

[c35] 35. The method of claim 31, further comprising forcing at least approximately all the gas outwardly out of the flow channel.

[c36] 36. The method of claim 31 wherein the flow channel is one of a plurality of flow channels, each having an inner region and an outer region disposed outwardly from the inner region, and wherein the method further comprises forcing gas within the flow channels generally outwardly through the flow channels to the outer regions of the flow channels.

[c37] 37. The method of claim 31, further comprising filling the flow channel with the second generally non-conductive material.

[c38] 38. A microelectronic package, comprising:

a microelectronic substrate having a first surface, a second surface facing opposite from the first surface, and a plurality of first connection sites at least proximate to the first surface;

a support member having a plurality of second connection sites positioned proximate to the first connection sites of the microelectronic substrate, the support member further having a plurality of third connection sites accessible for electrical coupling to other electrical structures;

a plurality of electrically conductive couplers connected between the plurality of first connection sites of the microelectronic substrate and the plurality of second connection sites of the support member, with neighboring conductive couplers being spaced apart to define at least one flow channel, the at least one flow channel being in fluid communication with a region external to the microelectronic substrate; and

a generally non-conductive material disposed on the microelectronic substrate between neighboring conductive couplers, the generally

non-conductive material being offset from the support member to define a portion of the at least one flow channel.

[c39] 39. The package of claim 38 wherein the microelectronic substrate has a peripheral region and wherein the package further comprises an adhesive film disposed between the microelectronic substrate and the support member at the peripheral region, the adhesive film being positioned to allow cooling flow to pass into the cooling flow channels.

[c40] 40. The package of claim 38 wherein the conductive couplers include solder balls.

[c41] 41. The package of claim 38 wherein the at least one of the flow channel has a dimension generally normal to the microelectronic substrate of about 25 microns.

[c42] 42. A plurality of microelectronic device assemblies, comprising:

a first microelectronic device assembly that includes:

a first microelectronic substrate having a first surface, a second surface facing opposite from the first surface, and a plurality of first connection sites positioned at least proximate to the first surface, each first connection site carrying a first flowable, electrically conductive coupler, each first conductive coupler having a first outer surface spaced apart from the first surface of the first microelectronic substrate by a first distance, the first outer surfaces defining a first plane;

a first generally non-conductive material applied to the first conductive couplers and the first surface of the first microelectronic substrate and recessed from the first plane by a first recess distance;

a second microelectronic device assembly that includes:

a second microelectronic substrate having a first surface, a second surface facing opposite from the first surface, and a plurality of second connection sites positioned at least proximate to the first surface, each second connection site having a second flowable, electrically conductive coupler, each second conductive coupler having a second outer surface spaced apart from the first surface of the second microelectronic substrate by a second distance different than the first distance, the second outer surfaces defining a second plane; and

a second generally non-conductive material applied to the second conductive couplers and the first surface of the second microelectronic substrate, the second support material being recessed from the second plane by a second recess distance at least approximately the same as the first recess distance.

[c43] 43. The assemblies of claim 42 wherein the first microelectronic device assembly further includes a first support member having third bond sites, with the first conductive couplers connected between the third bond sites and the first bond sites of the first microelectronic substrate; and

wherein the second microelectronic device assembly further includes a second support member having fourth bond sites, with the second conductive couplers connected between the fourth bond sites and the second bond sites of the second microelectronic substrate.

[c44] 44. The assemblies of claim 42 wherein the first microelectronic device assembly further includes a first support member having third bond sites, with the first conductive couplers connected between the third bond sites and the first

bond sites of the first microelectronic substrate, further wherein neighboring first conductive couplers are spaced apart to define at least one first flow channel; and

wherein the second microelectronic device assembly further includes a second support member having fourth bond sites, with the second conductive couplers connected between the fourth bond sites and the second bond sites of the second microelectronic substrate, further wherein neighboring second conductive couplers are spaced apart to define at least one second flow channel.

[c45] 45. The assemblies of claim 42 wherein the first recess distance is about 25 microns or more.

[c46] 46. The assemblies of claim 42 wherein the first microelectronic device assembly includes a first support member bonded to the first conductive couplers, and wherein the first microelectronic device assembly further includes a first underfill material between the first support member and the first microelectronic substrate, the first underfill material having particles with a mean diameter, the first recess distance being about three times the mean diameter or more.

[c47] 47. The method of claim 42 wherein the first and second conductive couplers include solder balls.

[c48] 48. A microelectronic package, comprising:

a microelectronic substrate having a first surface, a second surface facing opposite from the first surface, and a plurality of first connection sites at least proximate to the first surface, each first connection site carrying a flowable, electrically conductive coupler;

a support member having second connection sites attached to the conductive couplers; and

at least one generally non-conductive material adjacent to the conductive couplers, the at least one generally non-conductive material being spaced apart from the support member.

[c49] 49. The package of claim 48 wherein the at least one generally non-conductive material includes a first generally non-conductive material, and wherein the support member includes a second generally non-conductive material disposed adjacent to the conductive couplers and spaced apart from the first generally non-conductive material.

[c50] 50. The package of claim 48 wherein at least one of the conductive couplers has a first interface surface adjacent to one of the first connection sites, a second interface surface adjacent to one of the second connection sites, and an intermediate surface between the at least one and second interface surfaces, and wherein the at least one generally non-conductive material extends outwardly along the intermediate surface from the first connection site.

[c51] 51. The package of claim 48 wherein the at least one generally non-conductive material defines at least one surface of at least one flow channel.

[c52] 52. The package of claim 48 wherein the at least one generally non-conductive material includes an epoxy.

[c53] 53. The package of claim 48 wherein the conductive couplers include solder balls.